Virginia's Flight to 2025

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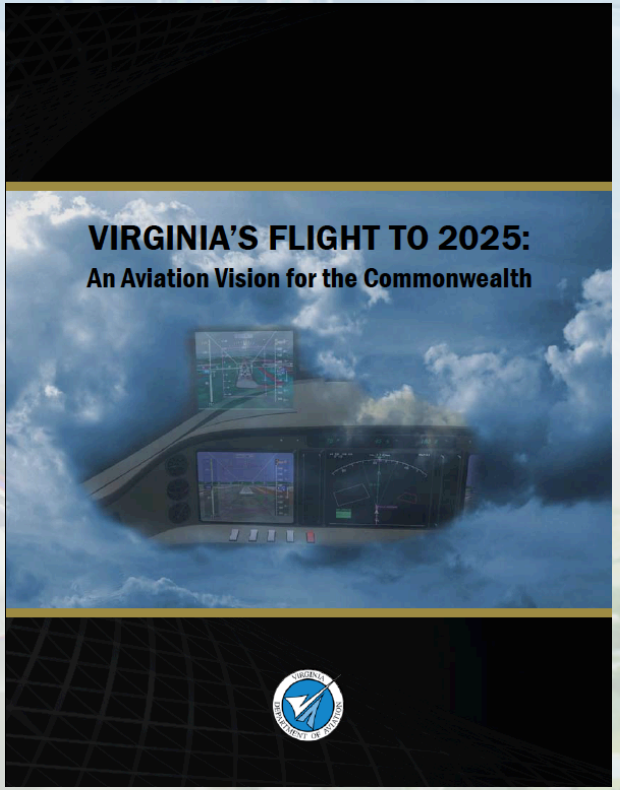
Virginia – GA Benefits

- **Quality of Life**
  - **Mobility for Virginians**
  - **Economic Development Opportunities for all Virginia communities**
- **NextGen Promise supports GA**
  - **NAS Productivity**
  - **NAS Access**
  - **Safety**

Virginia's Aviation Vision

- **Inform citizens/policy makers**
- **Excite stakeholders to unite for progress**
  - **Virginia businesses**
  - **FAA**
  - **NASA**
  - **Aviation product manufacturers & service providers**
  - **Aviation associations – AOPA, NASAO, VABA, etc.**
  - **Academia**



Virginia's Planned Investments

- **Improve weather reporting at GA airports**
- **Modify NADIN data requirements**
- **Develop GPS approaches to every runway end**
- **Encourage widespread ADS-B equipage in GA through partnerships**
- **Market GA**
- **Enhance terminal facilities**

- **These form the foundation of a NextGen GA Testbed upon which others can build**

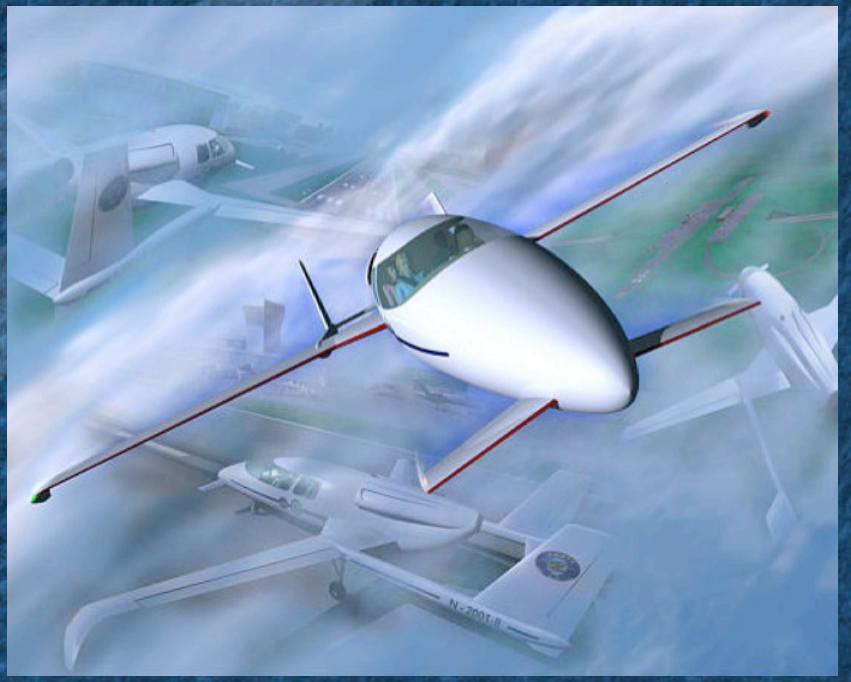
Partnering Opportunities

- **FAA – Show GA community benefits of ADS-B**
- **NASA – R&D environment needed to mature advanced airspace procedures**
- **NWS – sensor network**
- **Avionics Manufacturers – product development and marketing**
- **GA Operators – equipment in exchange for operational data**

- **ITT – new business development opportunity**
- **Academia – NextGen workforce development**

NextGen Testbed & Research Partnering Opportunities

- Datalink - Aircraft and Ground
  - NextGen Weather
- Remotely-Staffed NextGen Tower
- Increased GA safety
  - ADS-B Application to Wake Vortex Mitigation
  - Increased utility of Portables
- UASs in the NAS
- Dynamic SUA management
- Equivalent Visual Operations at GA airports
- Air Taxi Economic Impact Modeling
- Outreach – What NextGen means to GA Operators



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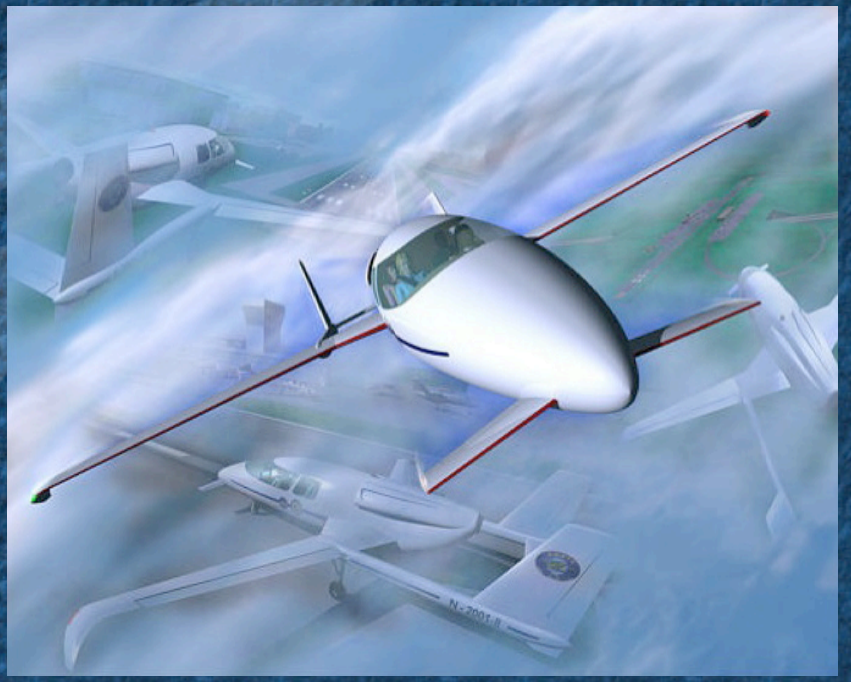

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Example – Weather Reporting "Mini-Case"

(7) Uplink via ADS-B (UAT) or AAtS (IP connection)
- Weather forecast data for all airspace users
- PIREPs for localized traffic

(1) A/C sensor data downlink
- Airspeed, winds, moisture

(2) Events Detected
- Turbulence, wind shear

(3) Downlink via ADS-B (UAT) or AAtS (IP connection)
- Data routed to AAtS gateway

FAA, NWS (4D Wx Cube)

(4) Data feeds 4D Wx Cube
- Low altitude convective models

(5) Auto PIREPs recorded
- Ride reports, turbulence, etc.

(6) Weather and PIREPs disseminated

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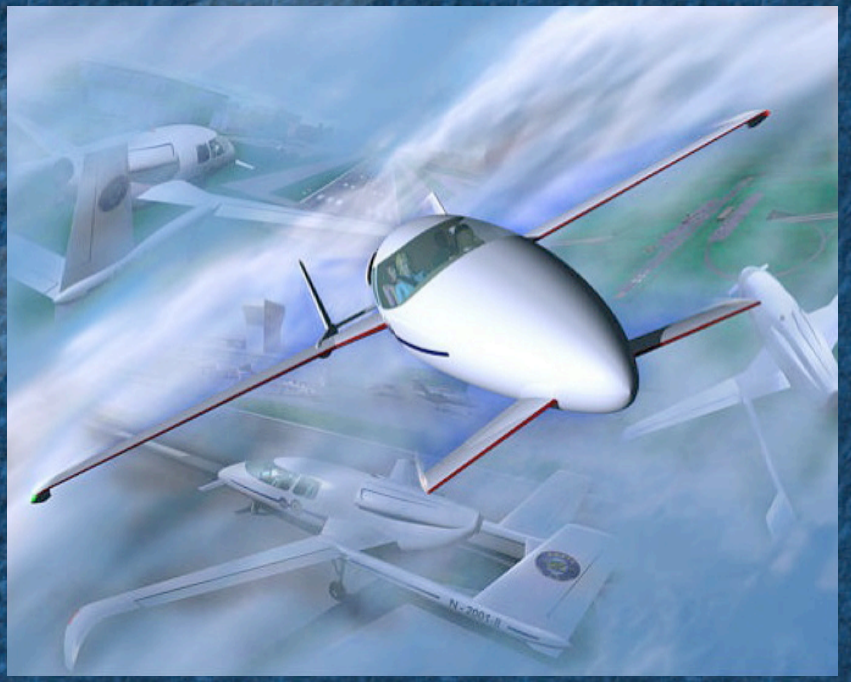

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Ending One In, One Out

through ADS-B Surveillance to the Ground

- **IMC throughput at non-towered airports is 1/3 - 1/4 VMC**
  - **Affects businesses' ability to deliver reliable service**
  - **Displaces traffic to Commercial Service airports**
  - **Adds to airspace congestion and environmental impact**
- **ADS-B surveillance to the ground enables basic Remote Tower capability**
  - **Improves usefulness of equip**
  - **Permits seamless surface-to-surface traffic control**
  - **Reduces operational variability at small business-critical airports**

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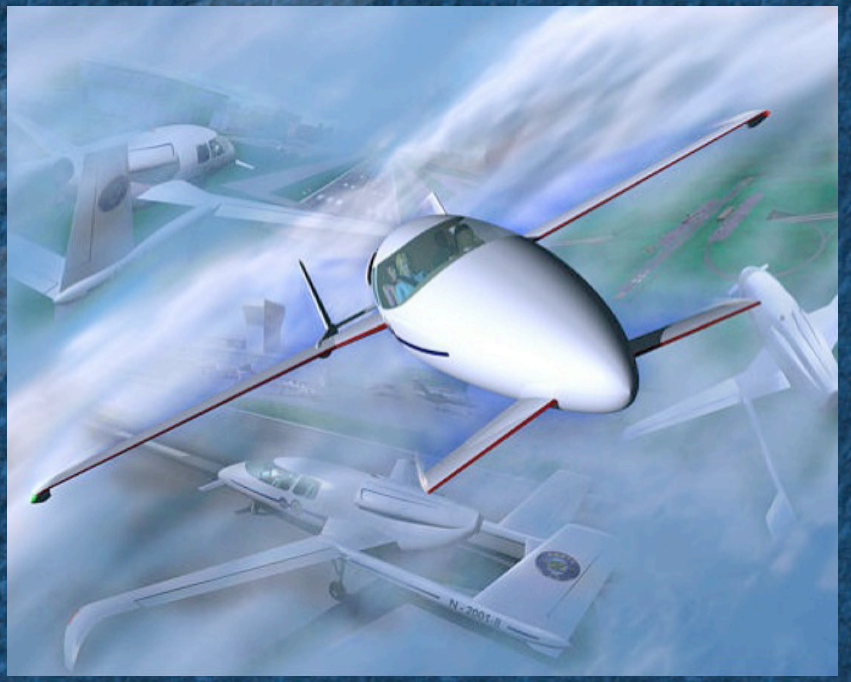

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Wake Vortex Encounter Mitigation

- **Develop Wake-Encounter Hazard Metric**
- **Pass aircraft type, weight, speed, and winds to trailing aircraft**
- **Model wake on-board trailing aircraft**

- **Display probable wake location in trailing aircraft**
- **Include Zones of varying Wake-Encounter Hazard Metrics**

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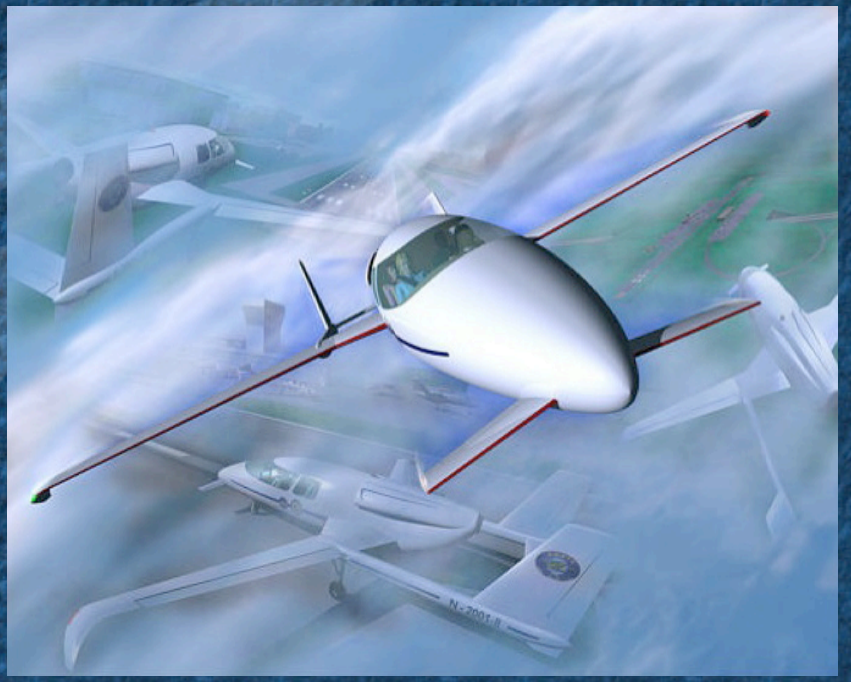

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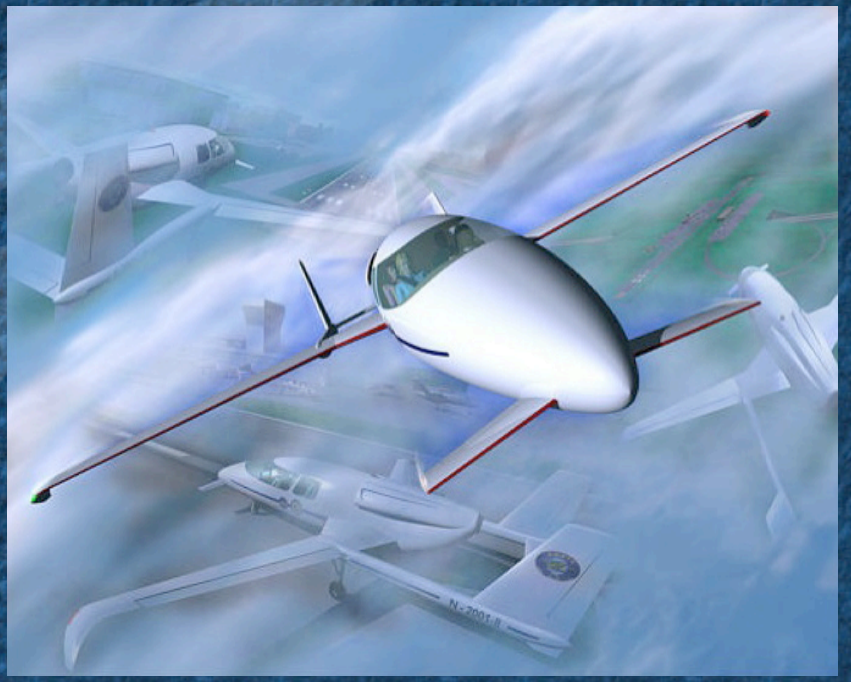

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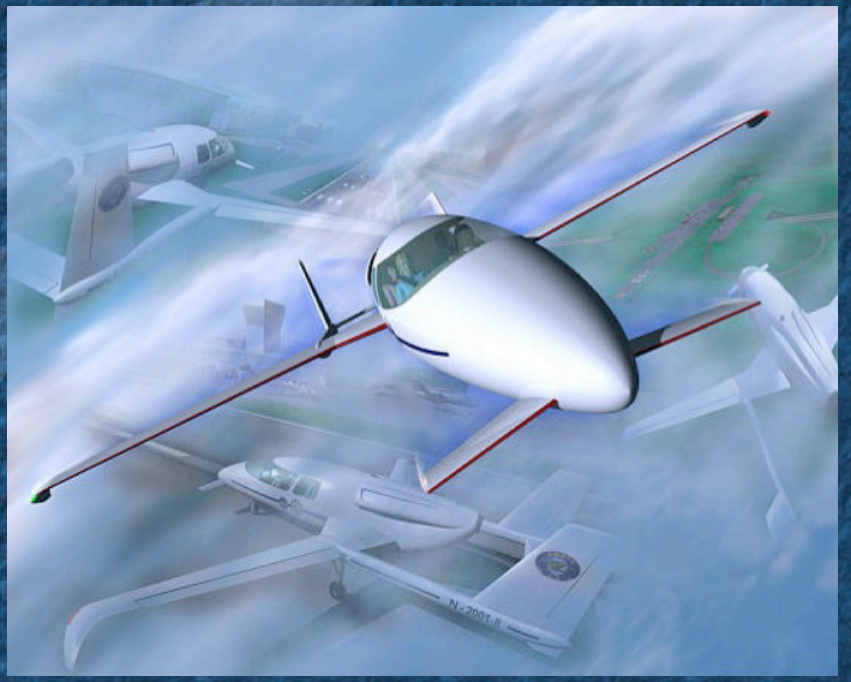

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Visible-Light Image Processing

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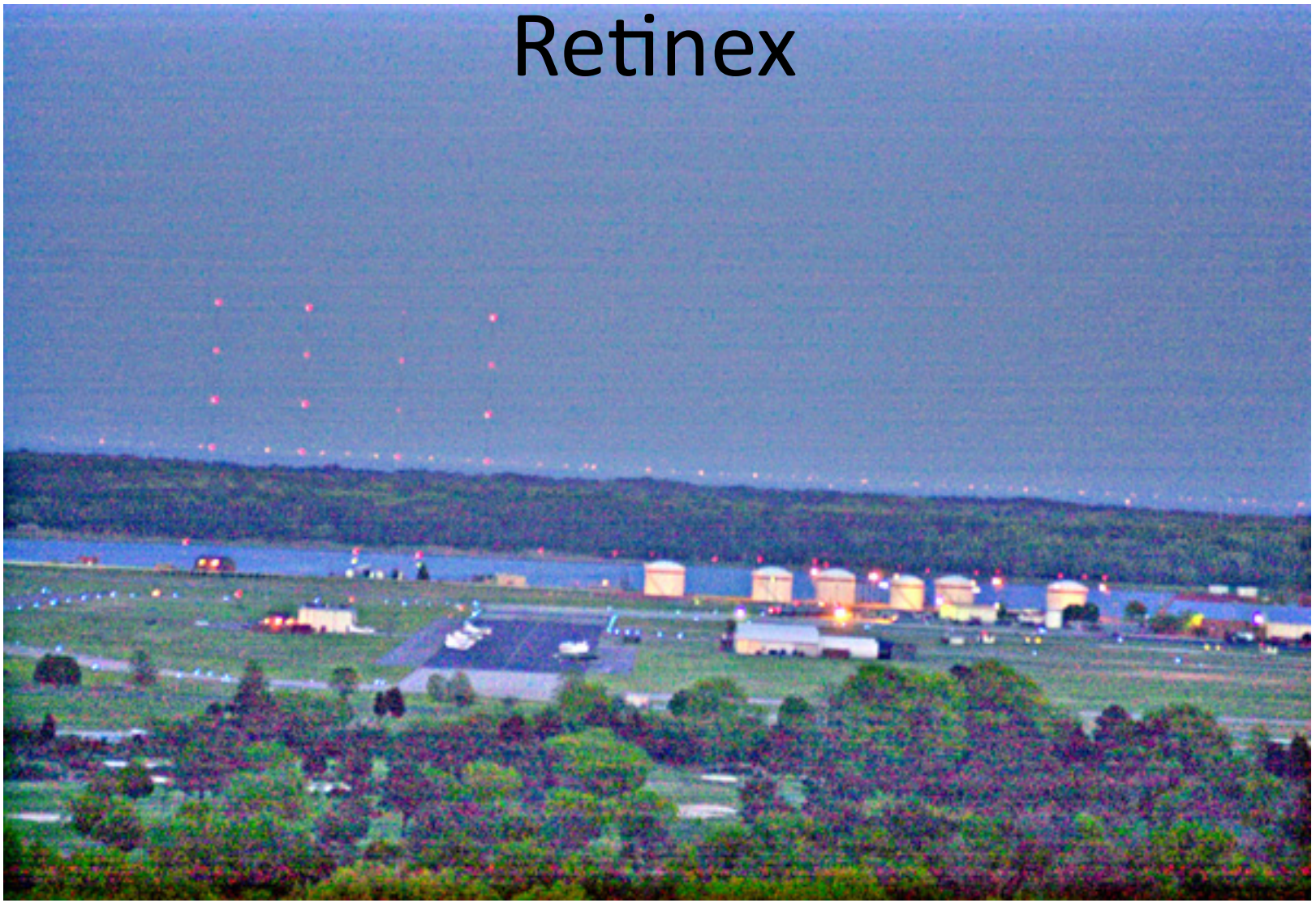

Visible-Light Image Processing

Retinex

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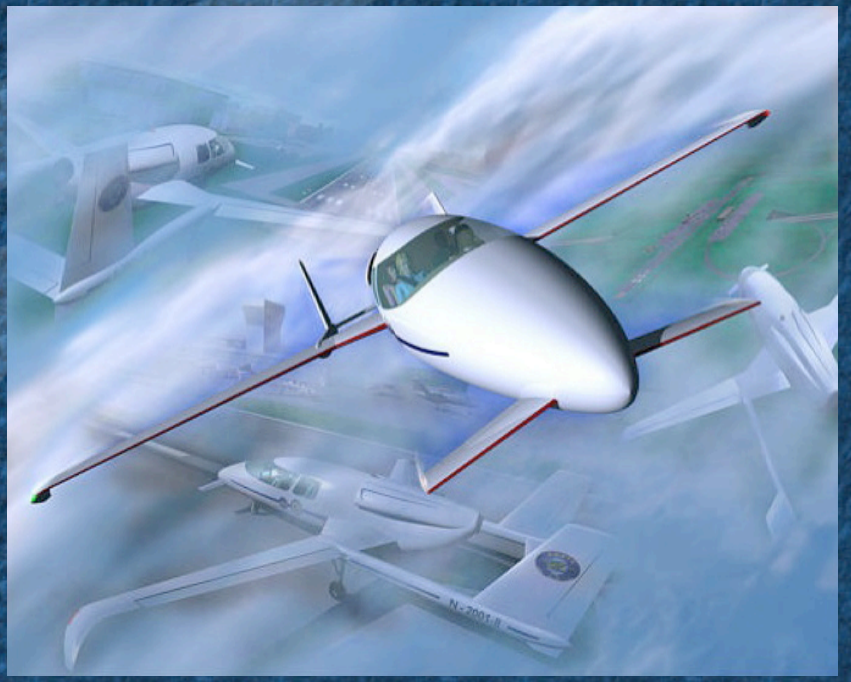

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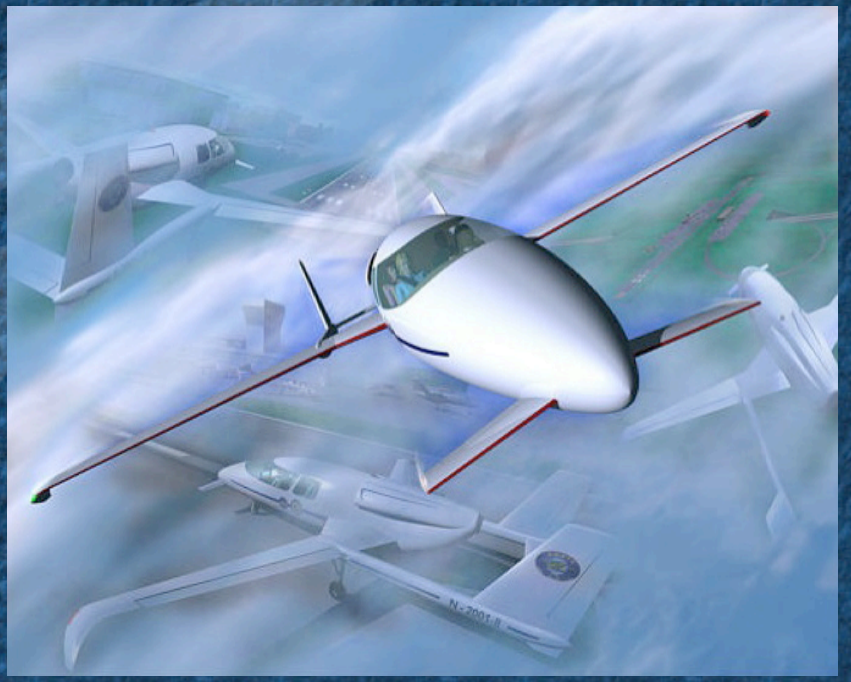

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Airspace Program

• Provide **all airspace system users** more flexibility and efficiency in the use of airports, airspace and aircraft.

• Enable accurate modeling and simulation of air transportation systems

• Accommodate operations of **all classes of aircraft**

Concepts and Technology Development Project

• Dynamic Airspace Configuration (Dynamic SUA, Remote GA Tower)
• Separation Assurance (Remote Tower - Air and Ground elements)
• Super Density Operations (Wake Encounter Mitigation)

Systems Analysis, Integration, and Evaluation Project

"… R&D **maturation** of these integrated concepts through evaluation **in relevant environments** …"

Aviation Safety Program

System-wide Safety Assurance Technologies (SSAT) Project: proactively manage **increasing complexity in the design and operation** of vehicles and air transportation systems, ...

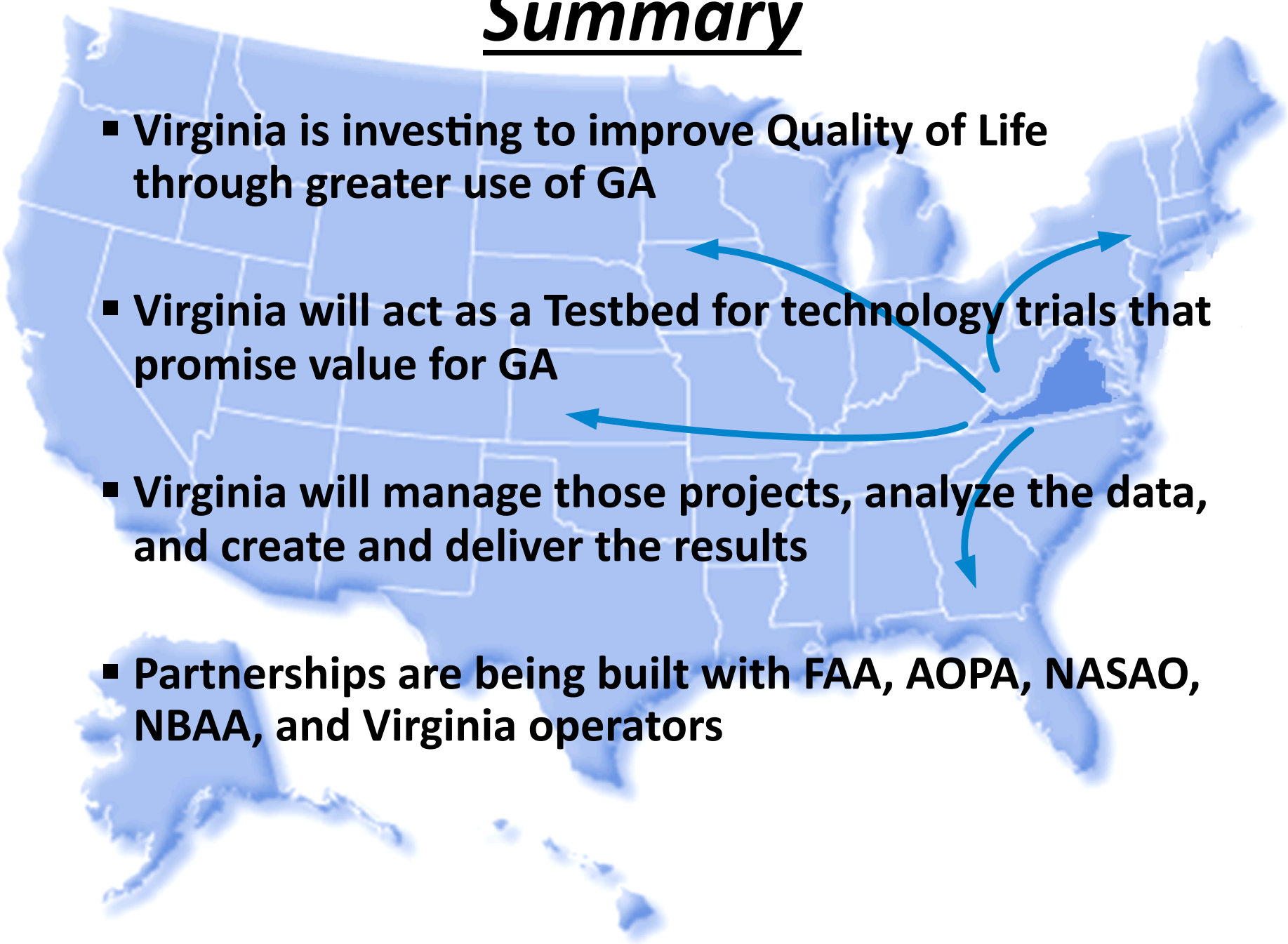
Atmospheric Environment Safety Technologies (AEST) Project: investigates sources of risk and provides technology needed to help ensure safe flight in and around **atmospheric hazards**.

Integrated Systems Research Program

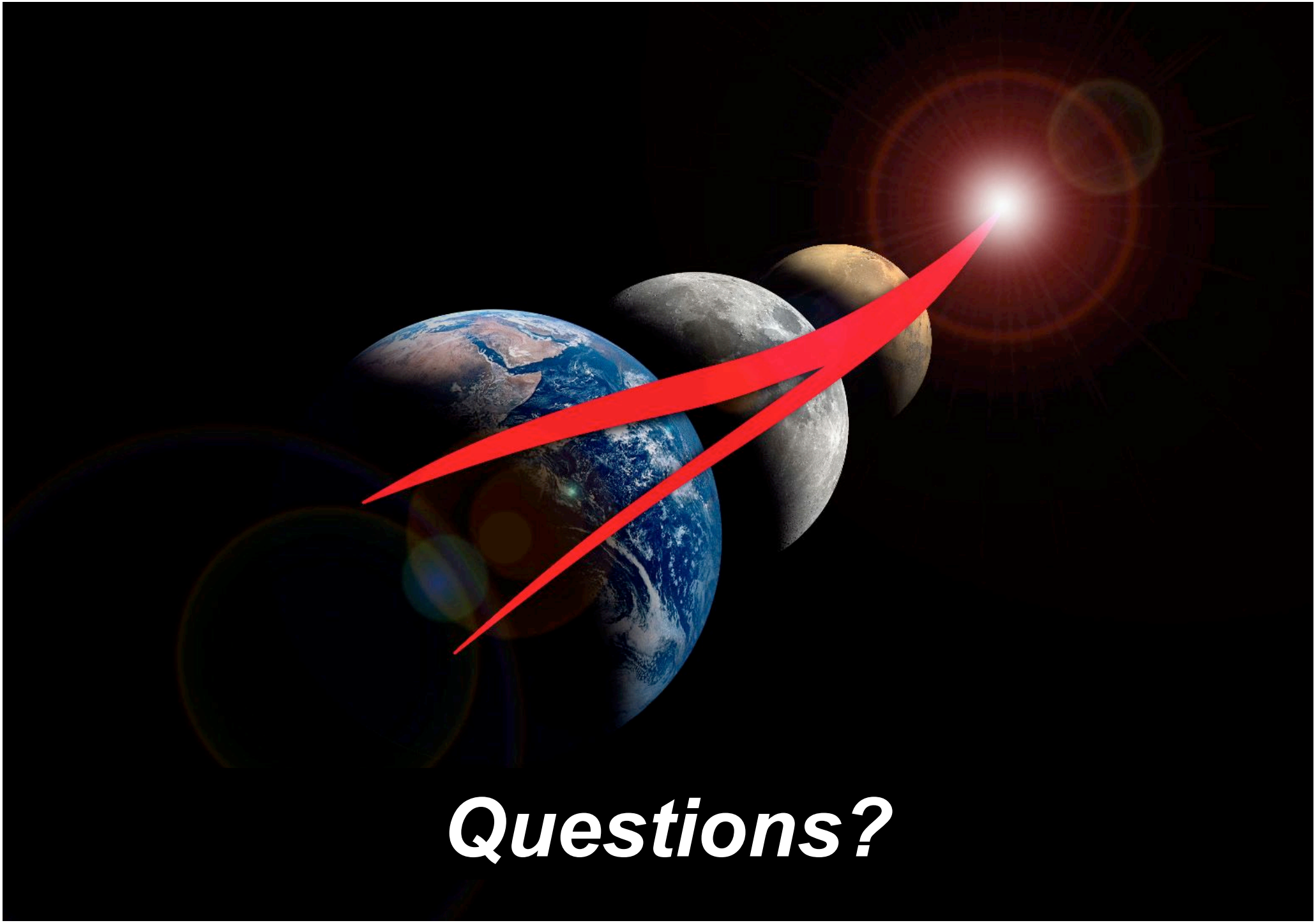
UAS Integration in the NAS Project

"UAS are unable to routinely access the NAS today due to a lack of automated separation assurance integrated with collision avoidance systems, robust communication technologies, robust human systems integration, and standardized safety and certification guidelines."

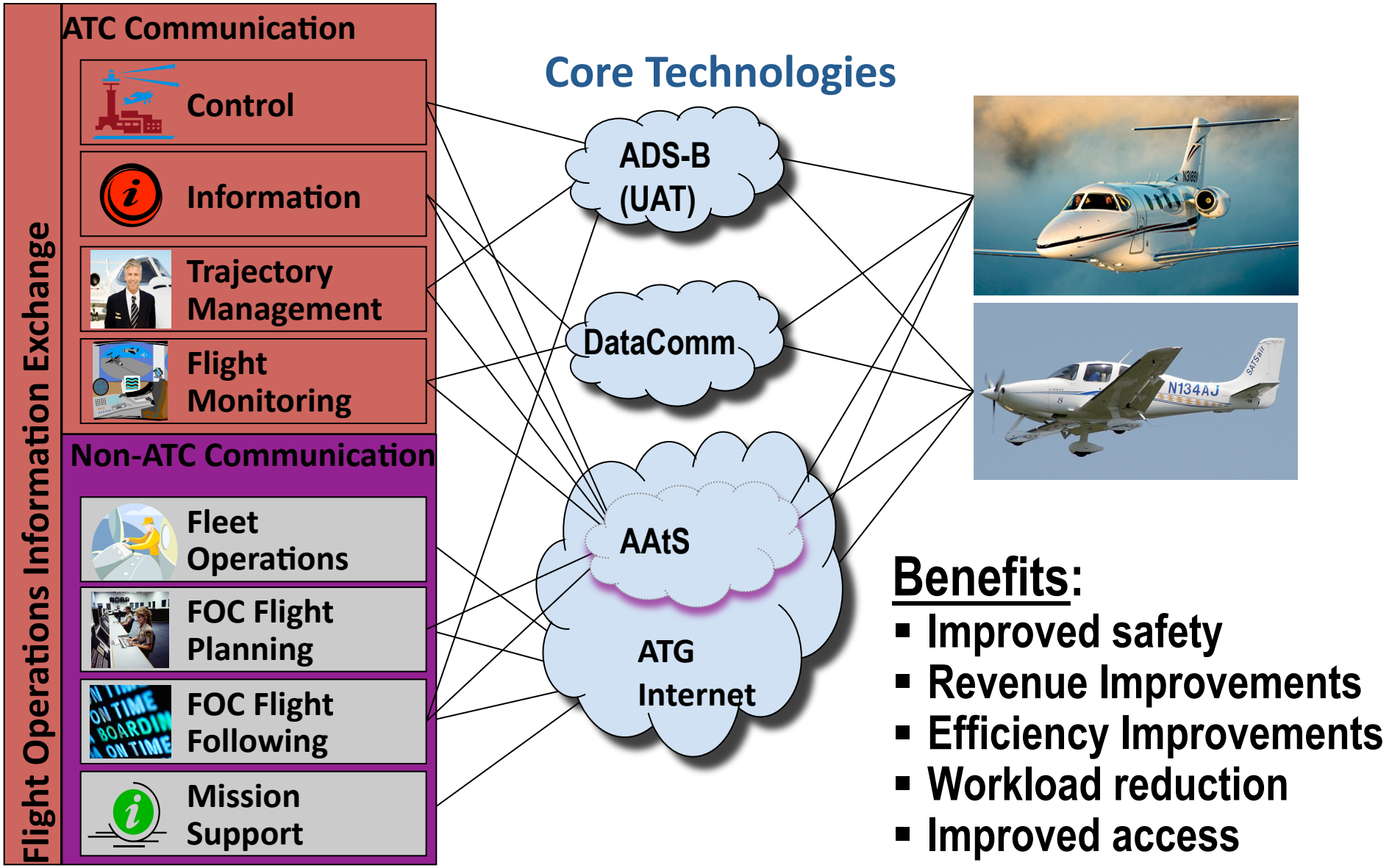
Summary



- **Virginia is investing to improve Quality of Life through greater use of GA**
- **Virginia will act as a Testbed for technology trials that promise value for GA**
- **Virginia will manage those projects, analyze the data, and create and deliver the results**
- **Partnerships are being built with FAA, AOPA, NASAO, NBAA, and Virginia operators**


Questions?

FIX Capabilities Overview

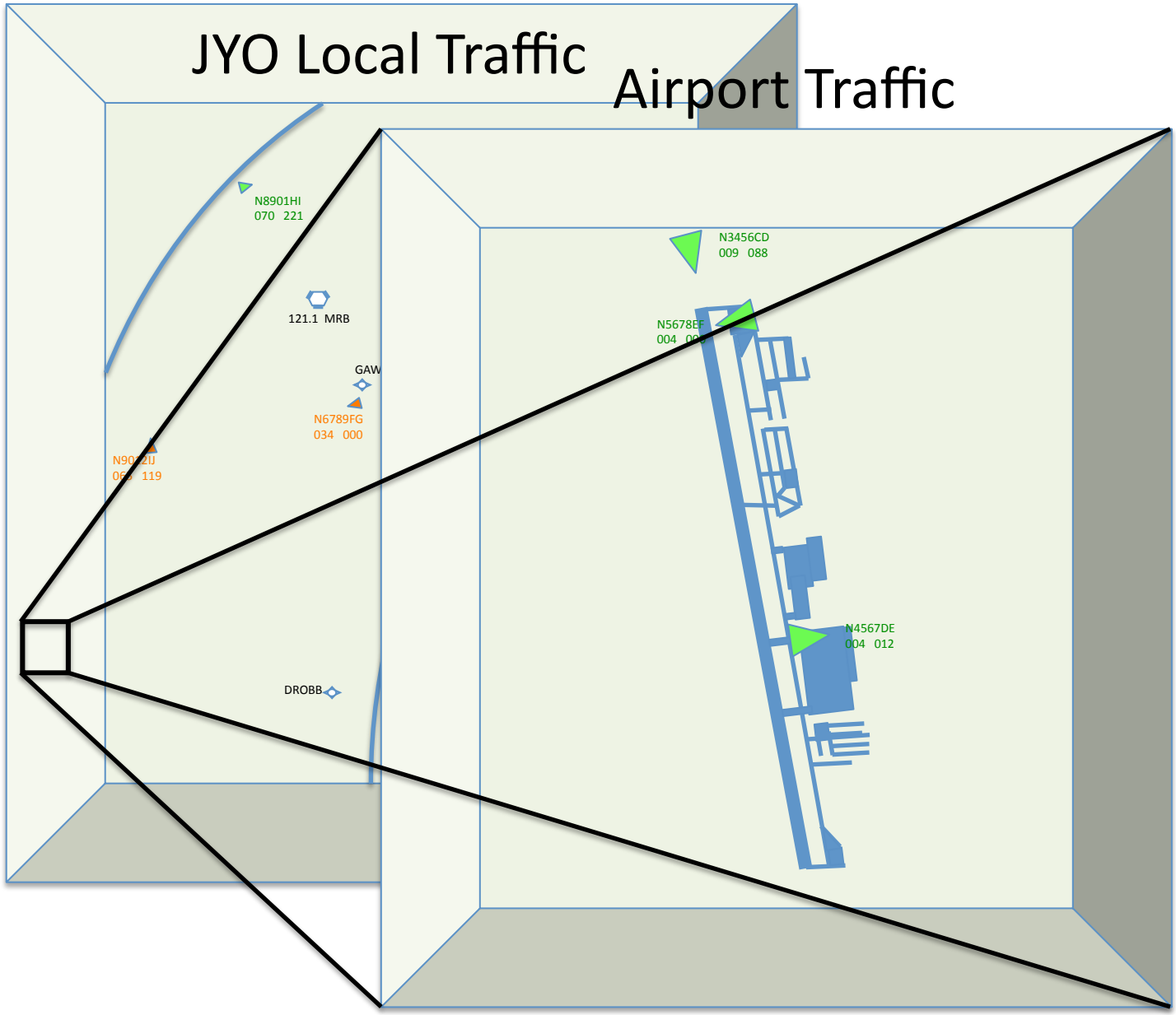


Benefits:

- Improved safety
- Revenue Improvements
- Efficiency Improvements
- Workload reduction
- Improved access

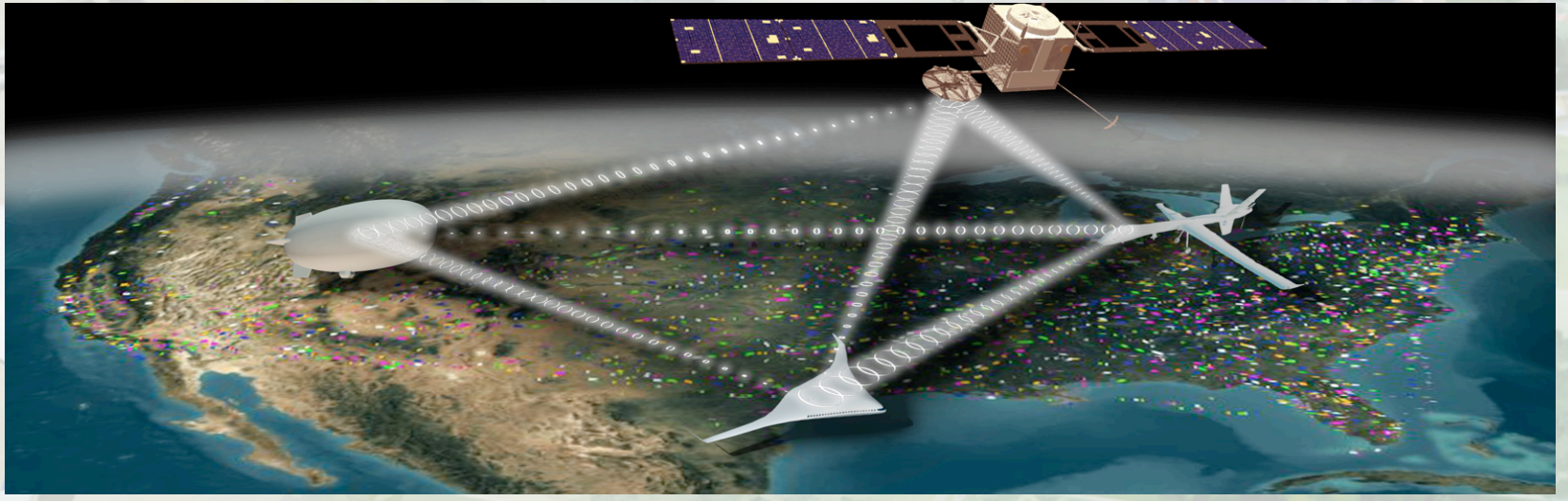
ATG = Aircraft-to-Ground

Remote Controller's Views



Utility of Low-cost ADS-B Receivers

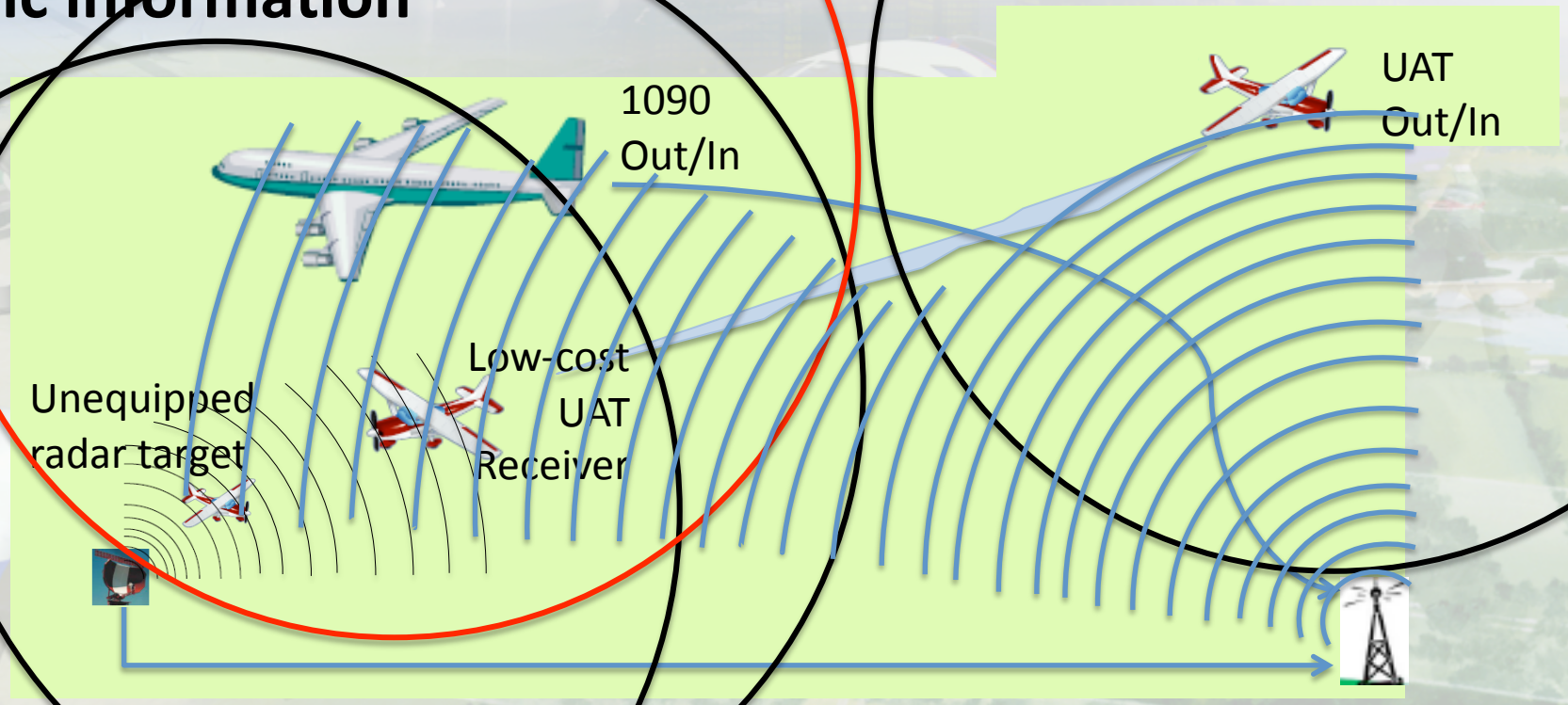
- **Low-cost ADS-B Receivers**
  - **improve situation awareness and safety**
  - **enable informed route-change requests**
  - **provide affordable entry into ADS-B equipage**
  - **show operators the advantages of being ADS-B equipped**
- **Low-cost ADS-B Receivers currently only get limited traffic information**



Low-cost ADS-B Receivers: Suggested Utility Improvement

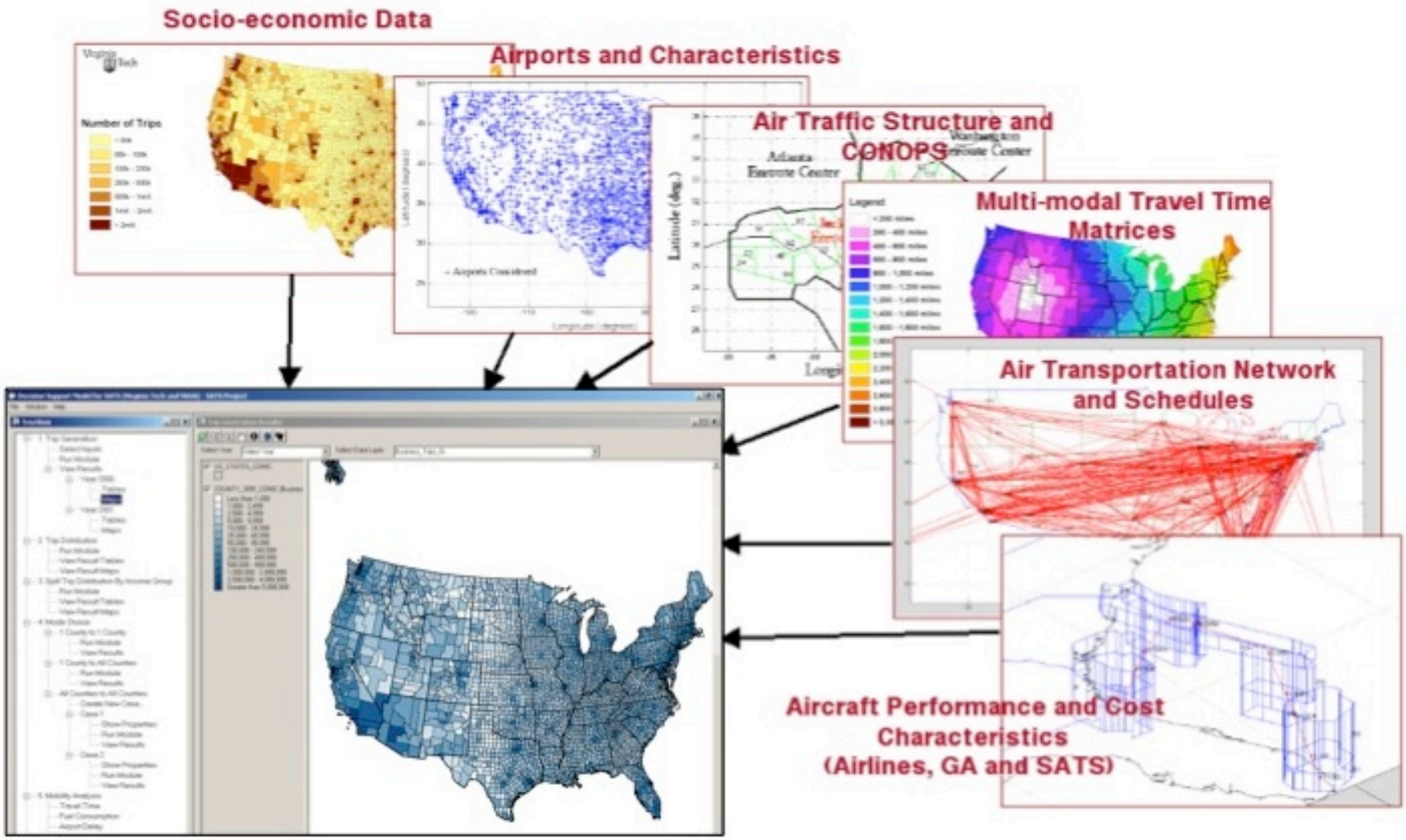
- Broadcast traffic around every detected aircraft
  - Radar & cross-linked traffic if ADS-B Out
  - All traffic near unequipped aircraft over UAT
- Duplicates will need to eliminated by receivers

- Lo
  traffic information



Travel Prediction Modeling

TSAM



Airspace Program

The benefit to the flying public from ASP research will be realized as a reduction in doorstep-to-destination trip duration and a cleaner environment.

• Accommodate projected growth in air traffic while preserving and enhancing safety.

• Provide all airspace system users more flexibility and efficiency in the use of airports, airspace and aircraft.

Key objectives of NASA Airspace Systems (AS) Program are to:

- Improve mobility, capacity efficiency and access of the airspace system;
- Improve collaboration, predictability, and flexibility for the airspace users;
- Enable accurate modeling and simulation of air transportation systems;
- Accommodate operations of all classes of aircraft; and
- Maintain system safety and environmental protection.

Airspace Program

Concepts and Technology Development Project

"… developing gate-to-gate concepts and technologies intended to enable significant increases in the capacity and efficiency of the NextGen, …"

Research Focus Areas

- Dynamic Airspace Configuration (Dynamic SUA, Remote GA Tower)
- Separation Assurance (Remote Tower - Air and Ground elements)
- Super Density Operations (Wake Encounter Mitigation)

Airspace Program

Systems Analysis, Integration, and Evaluation Project

"The SAIE Project is responsible for facilitating the R&D maturation of these integrated concepts through evaluation in relevant environments …"

Research Focus Areas

- **Integration, Evaluation and Transition (IET)** integrates ASP concepts and technologies with each other and with existing and emerging NAS technologies to create evaluation environments that accurately represent NextGen.
- **System and Portfolio Analysis (SPA)** - In order to properly assess the NAS, a series of system-wide assessments will make use of the outputs from the individual design studies, airport, and metroplex studies to determine the incremental benefits achieved as ASP research progresses.

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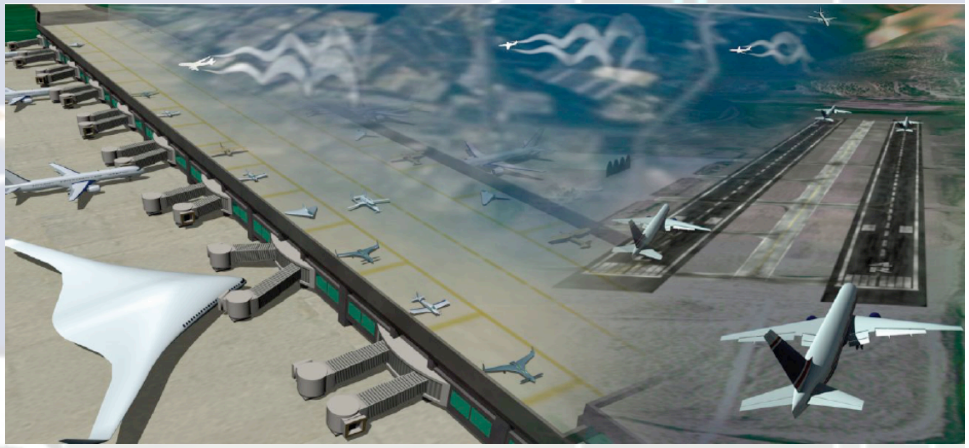
Why Virginia?

- DOAV
  - Connected, Influential, & Progressive
- Location
  - Terrain, Airspace, & near DC
- Aerospace Research Consortium
  - NASA, Universities, & Industry

Outreach Messaging

- Partners will perform outreach with their extensive communication assets as appropriate
  - FAA is working with GA
  - Expected and measured costs-benefits
- Additional outreach through conferences and specific meetings with organizations such as AOPA, NASAO, NBAA, VABA, JPDO, EAA, and ATCA and with OEMs
- Projects will support FAA NextGen Outreach team

Early Implementations of NextGen



- EIPs, to date, are all aimed at airlines
- FAA 2009 data
  - 95% of US fleet is GA
  - 56% of flight hours are GA
  - Even 51% of the operations at Dulles were GA
- GA must be motivated to implement NextGen for the benefits to be fully realized

Increasingly "Intelligent" Vehicles

- Sensing / perceiving
- Integrated awareness
- Response execution

- **Effective interaction with users will still be a key determinant of usefulness**

Goals

- Automation and interface technologies that enable high performance partnerships between highly automated vehicles and human users

- Flight vehicles

- Other vehicles

Reinventing Pilot-Vehicle Relationship

Successful Human-Autonomous Vehicle System Exemplar

"H"- Metaphor, guidelines for:

- Vehicle as an autonomous agent
- Human-vehicle interaction
- Multi-vehicle interaction
- ref. NASA TM 2003-212672